

Participant perspectives of automated short messaging service interventions to promote physical activity: A systematic review and thematic synthesis

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Abstract

Introduction: Short messaging service has the potential to improve participation in physical activity in individuals with long-term health conditions. However, successful implementation relies on participant engagement with such programmes. The aim of this study was to undertake a systematic review of qualitative literature exploring participant perspectives of short messaging service-based interventions designed to promote physical activity for people with long-term health conditions.

Methods: CINHAL, MEDLINE, SPORTSDiscus, Scopus and Web of Science were searched up to 15 February 2021 looking for participants' perspectives on short messaging service programmes designed to promote physical activity in people with long-term health conditions. Included studies were analysed using thematic synthesis.

Results: Eight studies involving 533 participants were included and analysed using the principles of thematic analysis and 10 descriptive themes were identified. These descriptive themes were further refined to develop five final analytical themes: *taking control of my own health, from information to action, relationship with the programme, perfection required for success and increased expectations.*

Discussion: The findings agree with published work on the factors which influence behaviour. The findings from this synthesis demonstrate that automated short messaging service programmes to increase physical activity are generally acceptable. People report that these interventions support and encourage physical activity. The novel finding of this study was that having more regular and long-lasting contact has the potential to increase the expectations people have of healthcare services. This is a finding which needs to be considered and managed but should not discourage the use of automated short messaging service.

Keywords

Participant perspectives, automated messages, physical activity, qualitative, meta-synthesis, short messaging service

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Introduction

Healthcare resources cannot keep pace with consumer expectation, particularly in the area of long-term conditions.^{1,2,3} Information and communication technologies (ICTs) have created an opportunity for healthcare to adapt, supplement or even replace face-to-face contact. This has the potential to increase access, decrease costs and reduce the burden on clinicians.⁴

In a recent bibliometric review, Müller and colleagues identified an increase in research using ICT to promote

physical activity.⁵ Mobile phones provide an accessible form of ICT with the number of phones exceeding the

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current global population.⁶ Short messaging service (SMS) is ubiquitous, and SMS-based interventions have been shown to prompt behaviour change and improve health outcomes in many healthcare settings.^{7,8} This suggests that SMS has the potential to improve participation in physical activity in its broadest definition,¹ including in specific exercise programmes, in a variety of populations. However, successful implementation relies on participant acceptance of, and engagement with such programmes.

The aim of this study was to undertake a systematic review of peer-reviewed qualitative literature exploring participant perspectives of SMS-based interventions designed to promote physical activity for people with long-term health conditions.

Methods

Design

A systematic review with thematic synthesis of qualitative data was undertaken. The systematic review was conducted in accordance with the PRISMA guidelines (Figure 1).⁹ No protocol was registered for this review.

Identification of studies

A search was undertaken up to 15 February 2021 using CINAHL, MEDLINE, SPORTSDiscus, Scopus and Web of Science, with no restrictions placed on publication date. The search strategy combined terms for study design (qualitative), population (long-term condition, elective surgery), intervention and mode of delivery (physical activity, exercise, SMS and m-health) and participant experience (acceptability, experience). A full list of search terms can be found in online Supplemental material. Reference lists of final articles were manually screened to identify relevant studies missed in the primary search.

Study inclusion criteria

Studies were included if they met the following inclusion and exclusion:

Study design and reporting: Included studies were qualitative, mixed methods with an independently reported qualitative component, available in full text, and published up until 15 February 2021. Those that were not in English, not peer-reviewed, or that were conference proceedings were excluded.

Population: Included studies involved adults with a long-term condition, and those who accessed an inpatient or outpatient service. Physical activity programmes are an important component of recovery after surgery, so this population was also included. Studies involving participants who were overweight or obese, without other long-term conditions, were excluded.

Intervention: Studies investigating intervention delivery using automated SMS to participants with a standard mobile connection, and those promoting physical activity-based rehabilitation were included. Those that did not deliver messages directly to participants (e.g. only delivered messages to family members) were excluded.

Outcome: Studies were included if they contained direct quotations of participant perspectives, experiences, suggestions and opinions concerning the intervention, or if the survey studied had free text responses expressing opinions. Studies were excluded if they reported results from closed question surveys, health-related quality of life or screening questionnaires, or the perspectives were from participants' family members, caregivers or healthcare professionals.

Study screening and selection

Articles were downloaded and imported into Endnote X8 ® software. Duplicates were removed in Endnote X8 ®. Initial screening of titles and abstracts was completed by JG and KH (research assistant) using the inclusion criteria. Disagreements were discussed until a consensus was reached. Where this was not possible, NS acted as arbitrator. Full texts of all remaining studies were read by JG and KH independently and discussed. Again, NS acted as an arbitrator when consensus could not be reached.

Study quality assessment

There is little consensus on whether the quality of qualitative literature can or should be assessed.¹⁰ For the current study, as suggested by Majid and Vanstone,¹¹ the CASP qualitative appraisal tool was used.¹² Regardless of quality, all studies meeting the inclusion criteria were included in the analysis; allowing readers to draw their own conclusions.

Data extraction and analysis

The included studies were imported into NVivo 12 Plus ® software and analysed using principles from an established protocol of thematic analysis and thematic synthesis by Thomas and Harden.¹⁰ Any text pertaining to participant perspectives of automated SMS-based interventions to promote physical activity were identified. Two researchers (JG, KH) independently completed line-by-line coding of relevant data and developed initial codes to summarise ideas presented in the text. These were then compared, and new collated codes were created to capture the agreed meaning of the portions of text, referring each time to their meaning in the context of the original study. Final codes were grouped into descriptive themes to summarise the original findings of the data. Descriptive themes stayed close to the original context and data of the original studies. The final stage of data analysis required a process

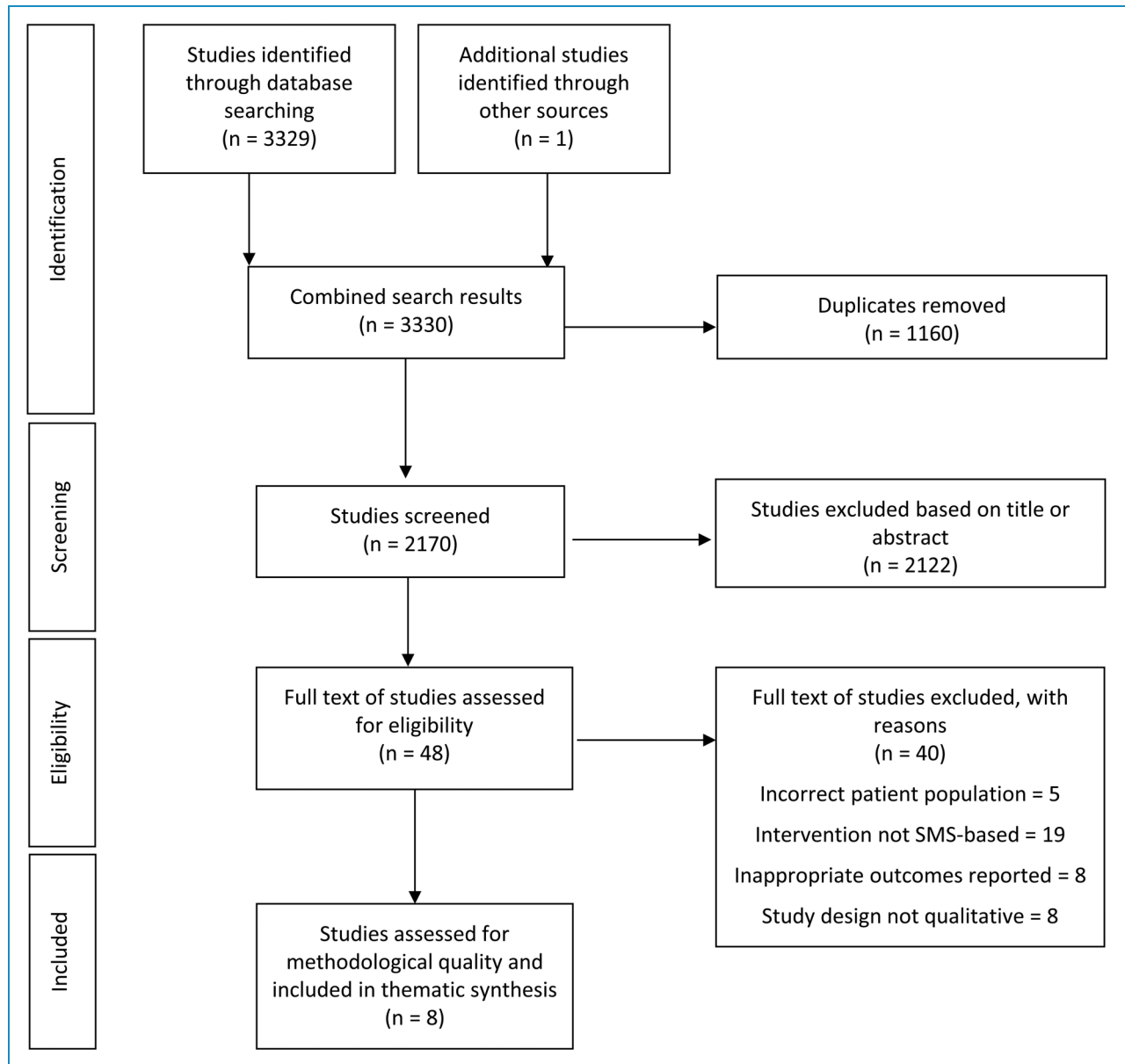


Figure 1. PRISMA flow diagram.

of developing themes not wholly grounded in the data from individual studies. The process of developing higher-order analytical themes was initially undertaken by JG and KH. These were then presented to a group of more experienced researchers (NS, VS). The data were interrogated for insights which would answer the original question and inform clinical practice. Online Supplemental material demonstrate the process of moving from initial codes through descriptive themes to analytical themes. This process was unavoidably linked to the background and experience of the team. The iterative process included researchers with a range of experience which helped to ensure generalisability of the results.¹⁰ KH was a final year physiotherapy student and JG a junior physiotherapist.

They were supervised by NS who is a physiotherapist with extensive clinical experience with this patient population, and expertise in this research methodology. VS also has considerable clinical experience as a physiotherapist and is part of the research team.

Results

Search results

The search of electronic databases identified 3329 publications; one further publication was identified from screening reference lists of relevant articles. After removal of duplicates, 2170 studies remained, 2122 of which were excluded

after the review of titles and abstracts. The full texts of the remaining 48 articles were screened, of which 40 were excluded with reasons. Eight articles were identified for inclusion in the thematic synthesis.^{13–20}

Study characteristics

Study designs included mixed methods,^{13,15} a qualitative component as part of a randomised controlled trials (RCTs),^{16,19,20} and primary qualitative studies.^{14,17,18} Participants had low back pain,¹⁸ non-small cell lung cancer,¹⁵ breast cancer,¹⁶ hypertension,¹⁷ heart disease^{13,19,20} or underwent elective joint arthroplasty.¹⁴ Studies were completed in six countries and in a range of socio-economic environments.

The eight studies collected data from 533 participants. Fewer than half (159) participated in face-to-face interviews or focus groups the remaining participants (374) provided feedback either via phone interviews or surveys allowing free text responses.^{13–20} All included RCTs collected qualitative data from only a sample of participants.^{13,15–17,19,20} Studies used the following methods to analyse data: thematic,^{13,16,17,19} content,¹⁵ constant comparative,²⁰ phenomenological analysis with systematic text condensation,¹⁸ and descriptive presentation of satisfaction data with participant quotes.¹⁴ Further details of the included studies are presented in Table 1.

Methodological quality

When the CASP criteria was applied, all studies had included study aims, justified use of the methodology, collected data appropriate to the research question, and clearly presented findings. Only four studies satisfied all elements of the CASP criteria.^{13,15,16,18} One criterion, the relationship between researchers and participants, was inadequately discussed in three of the studies.^{14,17,20} There was generally a lack of clarity as to how study findings contributed to existing knowledge, the impact on clinical settings and the generalisability of results to other populations. Further details can be found in online Supplemental material.

Results of analysis

Initial analysis yielded codes that were then collated to create 10 descriptive themes. These are defined in Table 2, using examples from the included studies.

The descriptive themes were then used to derive five analytical themes (Table 3). A detailed diagram of the derivation of each analytical theme can be found in online Supplemental material.

Analytical theme 1: From information to action. Participants noted being overwhelmed by information presented to them during the treatment process, making understanding

and remembering information difficult, specifically regarding exercise and physical activity. Receiving the same information in manageable portions, in a familiar environment, via SMS messages, allowed participants to remember and apply the advice to their everyday life. The added advantage of being able to refer to SMS messages allowed participants to undertake activity with increased confidence, increasing the likelihood of physical activity becoming habitual.

Analytical theme 2: Taking control of my own health.

Practical and psychosocial elements of the programmes seemed to encourage participants to adopt a more positive mindset, helping participants recognise that successful rehabilitation required taking ownership of their own health. Incremental adaptation of physical activity-related behaviour resulted in decreased reliance on the programmes, as physical activity became a valued and important component of participants' lifestyles. Participants reported having a greater commitment to personal goal setting and increased engagement with physical activity programmes. Occasionally this commitment went beyond basic engagement, with some participants planning their schedules around physical activity or investing in gym memberships to progress their programmes. Once these behaviours had been integrated into everyday life, participants noted less difficulty overcoming barriers that previously limited their engagement in physical activity, such as forgetfulness and indifference.

Analytical theme 3: Relationship with the programme. Many participants spoke about the messages as if they were from a trusted friend, rather than from an automated programme. This perception may have stemmed from the interaction with clinicians or researchers when the programme was commenced, and the personable language used in many of the messages. Messages were seen as a proxy for regular contact with a clinician and provided a similar sense of reassurance about recovery. This included explaining to the participant that occasional setbacks are likely, however, they are not a reason to stop physical activity.

Analytical theme 4: Well received when well delivered. When programmes did not meet participants' expectations or were delivered using messages that were not personally relevant, message fatigue developed. This resulted in loss of engagement with the programme and a subsequent reduction in the amount of physical activity undertaken. Participants reported that a poorly administered programme was worse than having no programme.

Analytical theme 5: Increased expectations. The regularity of the contact can set an expectation of a level of contact which may not be able to be sustained. Providers could be at risk of creating an expectation for extended contact that is neither practical to deliver nor helpful in encouraging

Table 1. Summary of studies included in thematic synthesis of automated short messaging service (SMS) interventions.

Author, Year, Country	Aim of Qualitative Study	Population	Study Design and Data Collection Method	Data Analysis Method	Context
Chen et al. 2018, China	Evaluate feasibility and acceptability of a 12-week SMS-based intervention intended to promote treatment adherence and lifestyle modification (including exercise).	n = 24, history of myocardial infarction or heart disease.	Mixed-methods pilot, 20-minute interviews with randomly selected participants	Thematic analysis.	Participants recruited from a community health centre in Shanghai and a tertiary hospital in Hainan province.
Day et al. 2018, USA	Assess participants' perspectives of a 3-week perioperative SMS-based intervention to provide information and promote activity.	n = 34, elective total joint arthroplasty.	Feasibility and acceptability pilot, phone survey post programme completion.	Descriptive presentation of satisfaction data, augmented with participant quotations.	Potential participants approached about participation during their preoperative appointment at least 7 days before their scheduled surgery.
Edbrooke et al. 2020, Australia	Characterise the views and experiences of participants who completed a 6-month home-based rehabilitation programme consisting of multiple mHealth components including a daily SMS exercise reminder.	n = 25, inoperable non-small cell lung cancer.	Mixed-methods, semi-structured interviews.	Content analysis.	Participants recruited from tertiary hospitals in Melbourne and had previously received 'usual care'.
Job et al. 2017, Australia	To explore participants' perspectives of a 6-month SMS-based intervention to promote physical activity, weight loss and dietary change.	n = 27, women, stage I-III breast cancer. All Caucasian women.	Qualitative reporting of an RCT, Semi-structured interviews.	Thematic analysis.	Participants completed a 6-month telephone-delivered intervention then invited to take part in a 6-month extended contact intervention delivered via text messages.
Leon et al.	Participants'	n = 22 (focus	Qualitative reporting	Thematic analysis.	Participants attending a

(continued)

Table 1. Continued.

Author, Year, Country	Aim of Qualitative Study	Population	Study Design and Data Collection Method	Data Analysis Method	Context
2015, South Africa	perspectives on the 'StAR' 12-month weekly SMS-based intervention to improve medication adherence and lifestyle factors (including exercise).	groups) and n = 15 (individual interviews), hypertension.	of an RCT, focus group and individual in-depth interviews with participants sampled from focus groups and outside the groups.		large public primary care clinic in Cape Town, South Africa.
Lilje et al. 2017, Sweden	To understand participants' perspectives on a 5-week SMS-based intervention to promote specific home exercises following a Naprapathic manual therapy programme.	n = 15, older adults, recurrent lower back pain.	Acceptability trial, semi-structured interviews.	Phenomenological approach with systematic text condensation.	Participants recruited from a private naprapathy clinic.
Pfaeffli Dale et al. 2015, New Zealand	To understand participants' perspectives on The Heart Exercise and Remote Technologies (HEART) trial. A 24-week SMS-based intervention with an accompanying website.	n = 17 (interviews), n = 75 (questionnaires), heart disease cleared to exercise.	Mixed-methods trial, semi-structured interviews, and surveys with open-ended questions.	Semantic thematic analysis.	Participants were recruited from two large metropolitan hospitals in Auckland, New Zealand. Purposive sampling used to also gain perspectives from minorities.
Redfern et al. 2016, Australia	To discover participants' perspectives on TEXT ME a 6-week SMS intervention to reduce coronary heart disease risk through the promotion of physical activity, diet modification and smoking cessation.	n = 25 (focus groups), heart disease.	Mixed-methods trial, Focus groups.	Constant comparative analysis.	Participants were recruited at a large tertiary centre and university teaching hospital in Sydney, Australia.

n, number of participants; RCT, randomised controlled trial.

Table 2. Descriptive themes and definitions.

Descriptive theme	Definition
<i>Positive perceptions result in behaviour change</i>	The programmes helped participants adopt positive attitudes, which contrasted with their previous ambivalence toward physical activity. ^{14,16–20} The increased engagement led some participants to progressing beyond the originally prescribed programmes. ^{13,17,19,20} Newly established habits were not always maintained after completion of the programmes. ^{18,20} Some participants suggested that longer interventions could be followed by a reduced frequency of text messaging to wean them off the programme. ²⁰
<i>Maintained a focus on rehabilitation</i>	The consistent delivery of messages made performing physical activity a priority and assisted focus on rehabilitation. ^{14,16,19} Frequent reminders kept participants on track helping them navigate barriers more readily. ¹⁹ Those with well-established physical activity habits found ongoing reminders were superfluous to their rehabilitation. ^{15,19}
<i>Contact alone is useful</i>	Many participants responded to the prompts received, completing prescribed activities immediately after the arrival of a message. ^{14–16,18–20} Participants believed prompting helped them complete their programme they would have otherwise forgotten. ^{13–18,20} Many believed regular prompting was helpful and the content of the messages was less important. ^{16,20} The messages promoted a sense of accountability and some participants expressed feeling guilty if they had failed to complete their programme. ²⁰
<i>Positive reinforcement</i>	Participants perceived messages as motivating, encouraging and challenging. ^{15–20} This resulted in positive reinforcement; especially for those with lower motivation. ¹⁵ Many participants treated the arrival of a messages as a reward, if they had already completed the programme that day. ^{14,18–20}
<i>Health education</i>	Some participants stated that messages covered information missed by traditional methods of health education, such as clinic appointments or brochures. ^{13,14,16–18,20} Isolated participants reported finding the programme their only source of health-related information. ¹³ Relevant and timely information helped participants understand their rehabilitation and instilled confidence to navigate common difficulties with performance of physical activities. ^{14,16,20} Some participants kept messages for reference, using them as a guide to address future health difficulties. ²⁰ Repeated concepts were recalled more easily than specific messages. ^{16,20}
<i>Universally applicable</i>	Participants believed that SMS programmes would be useful to people regardless of demography or background. ²⁰ However, this utility is limited by language and literacy; some participants in culturally isolated communities needed more language options or voice messages in the case of illiteracy. ¹⁷ Participants in geographically isolated, low resource settings shared the information with friends and family who did not have access to healthcare services. ¹³ Studies conducted in low resource settings found programmes were most valued when traditional services were unable to be delivered. ^{13,17} This is supported by participants suggesting that the programmes decreased their desire for face-to-face contact with clinicians. ¹⁴
<i>Personally supported and valued</i>	Messages were authored with personal and encouraging language, creating the impression of care and social support. ^{14,16,17,20} Participants understood the automated nature of the programme, but still felt the messages had a personal connection. ¹⁷ Many participants felt reassured by the programmes, the daily contact reduced stress and anxiety associated with illness. ^{14,16,17,20} There was a perception that clinicians were monitoring them daily, although this was not the case in most studies. ^{14–17,20} Participants who lived alone specifically appreciated consistent message delivery. ¹⁴
<i>Perfection required for success</i>	The programmes' potential was praised, regardless of its utility to a participant. ^{13–20} Participants who were not familiar with SMS found programmes less beneficial. ¹⁷ Messages were poorly accepted if they were not tailored to participants' conditions or recovery timeframes. ^{13,16,19,20} Participants liked it if a message took account of their lifestyle, particularly if messages were

(continued)

Table 2. Continued.

Descriptive theme	Definition
	received at times deemed appropriate. ^{13,16,19,20} Messages sent during work hours for working participants or early morning messages for late risers were not appreciated. ^{17,20}
<i>Active communication expectations</i>	The components of programme delivery varied between studies, with some allowing for two-way communication facilities (e.g. phone calls) to some or all participants during the programme. ¹⁴⁻¹⁷ Many participants in programmes without this facility were not content with messages alone and wanted regular phone calls or the ability to ask questions over SMS. ^{13,19,20}
<i>New discontentment</i>	Some participants were discontented with other health services following positive experiences with these extended contact interventions. ¹⁷ The ongoing contact and connection of these programmes led some participants to expect more from other services and to feel entitled to services beyond the scope of the respective interventions. ¹⁶

Table 3. Link between descriptive and analytic themes.

Descriptive themes	Analytic themes
<i>Health education</i>	<i>From information to action</i>
<i>Positive perceptions result in behaviour change</i>	<i>Taking control of my own health</i>
<i>Maintained focused on rehab</i>	
<i>Contact alone is useful</i>	
<i>Positive reinforcement</i>	
<i>Universally applicable</i>	<i>Relationship with the programme</i>
<i>Personally supported and valued</i>	
<i>Perfection required for success</i>	<i>Well-received when well delivered</i>
<i>Active communication expectation</i>	<i>Increased expectations</i>
<i>New discontentment</i>	

patient autonomy. This has the potential to result in dissatisfaction if the scope and purpose of the programme are not clearly explained at the outset of the intervention.

Discussion

This thematic synthesis has proposed five analytical themes which reflect consumers' perceptions of SMS messaging. It is clear from these themes that SMS messaging interventions to support physical activity has good acceptability. The themes give some insights into considerations for future development of automated rehabilitation interventions. These may support a change in behaviour allowing people to engage in physical activity, independent of

health care professionals. The first four themes from this research can be mapped on to a framework proposed by Michie and colleagues that helps understand factors such as *Capability*, *Opportunity* and *Motivation* and the interaction between these elements that can influence *Behaviour*: the COM-B (Figure 2).²¹

The final theme from this synthesis ***Increased expectations*** is, to our knowledge, a novel finding in the telerehabilitation literature. The theme refers to a clinical dilemma when an intervention designed to support the growth of long-term user autonomy and self-management in fact increases expectations of ongoing support. It does not refer specifically to a dependence on the automated messages. Rather, it appears to heighten the expectations of and demand for other services. In turn, this can have the effect of increasing user frustration with their healthcare in general.

This does not discount the applicability of automated interventions in clinical settings, and their use can still contribute to effective and acceptable care. They can be used as an adjunct in mixed delivery services,^{22,23} or at a point in rehabilitation when patient needs can be managed remotely and the user is willing and capable of engaging. A recent systematic review and meta-analysis of remotely delivered physical activity interventions found sustained between-group increases in physical activity at long-term follow-up.²⁴ This demonstrates that automated minimal contact has the potential to support people in maintaining physical activity.

Implications for practice

Automated SMS messages provide connectivity which appears to have benefits beyond those associated with physical activity. People report an ongoing sense of connection with the healthcare provider, especially those who are socially isolated or living alone and may not have the ability to regularly access services outside their home. Other authors have found similar themes when

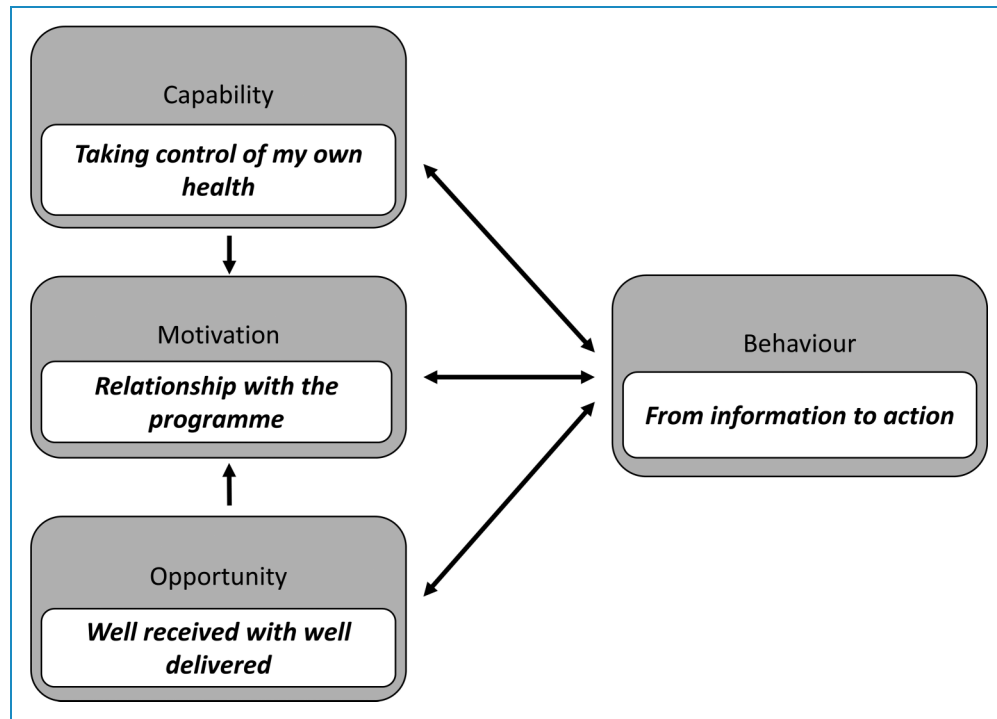


Figure 2. Findings from current synthesis (white) mapped onto the COM-B model (grey).

investigating perceptions of automated interventions in people with long-term conditions.²⁵

When prescribing a programme, people need to be given choices and where possible it should be tailored to an individual and their lifestyle. However, the benefits of automating a programme to enable widespread dissemination have the disadvantage of making individualisation and tailoring more difficult. Another limitation of current automation options is that most do not allow for two-way communication which is another frequently requested feature.

Next steps for research

Adverse events in these automated interventions are frequently poorly reported.²⁴ However, when they are reported, the number of incidents is low, the severity mild and most are unrelated to the intervention.^{26,27} Given the high acceptability and apparent low risk, the next step would appear to be to embed this as part of clinical practice.

Validated physical activity outcome measures could be used by participants and this data could be collected to allow auditing of the interventions. Outcomes could be measured using commercially available activity monitors such as wearable devices and phones or self-report telephone administered measures.²⁸

Strengths and limitations

A comprehensive search was conducted to identify literature exploring and analysing personal perspectives after

participating in SMS interventions. Studies included culturally and socioeconomically diverse populations, from a range of countries. A wide range of people with a broad range of health long-term conditions were included in data collection and synthesis which increased the generalisability of results. Coding was completed by authors with different backgrounds resulting in a rich interpretation of ideas which was reflected in the analysis. A thorough methodological critique and summary have been presented to ensure transparency.

Most of the included studies were multifactorial and did not deliver a purely SMS-based intervention to promote physical activity. This increased the complexity of coding, requiring robust discussion to decide which results were relevant to the intervention of interest for this study. Debate exists in the literature regarding the classification of obesity alone as a long-term condition. Physical activity and behavioural interventions intended to exclusively promote weight loss were outside of the scope of this study. This limits the generalisability of these findings to this group of people.

Conclusion

Participants' perspectives of automated SMS interventions were positive regardless of demographics health condition, or country of residence. There is a clear theme of people feeling supported and encouraged despite the lack of human contact. However, this is dependent on recipients

being willing, and capable, of engaging and having their personal preferences considered. Given the high acceptability and low risk, there seems little reason not to implement these programmes as part of usual care to increase engagement in physical activity beyond what is currently provided.

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References

1. Caspersen CJ, Powell KE and Christenson GM. Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Rep* 1985; 100: 126–131.
2. Chang AY, Skirbekk VF, Tyrovolas S, et al. Measuring population ageing: An analysis of the global burden of disease study 2017. *Lancet Public Health* 2019; 4: 159–167.
3. Xu K, Soucat A, Kutzin J, et al. Public Spending on Health: A Closer Look at Global Trends, <https://apps.who.int/iris/bitstream/handle/10665/276728/WHO-HIS-HGF-HF-WorkingPaper-18.3-eng.pdf?ua=1> (2018, accessed 4 June 2019).
4. Whittaker F and Wade V. The costs and benefits of technology-enabled, home-based cardiac rehabilitation measured in a randomised controlled trial. *J Telemed Telecare* 2014; 20: 419–422.
5. Müller AM, Maher CA, Vandelanotte C, et al. Physical activity, sedentary behavior, and diet-related eHealth and mHealth research: Bibliometric analysis. *J Med Internet Res* 2018; 20: 1–18.
6. The World Bank. Mobile cellular subscriptions (per 100 people). *The World Bank*, <https://data.worldbank.org/indicator/it.cel.sets.p2?page=4> (2019, accessed 16 May 2019).
7. Krishna S, Boren SA and Balas EA. Healthcare via cell phones: A systematic review. *Telemed J E-Health Off J Am Telemed Assoc* 2009; 15: 231–240.
8. Nundy S, Mishra A, Hogan P, et al. How do Mobile phone diabetes programs drive behavior change? Evidence from a mixed methods observational cohort study. *DIABETES Educ* 2014; 40: 806–819.
9. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Br Med J* 2009; 339: 1–8.
10. Thomas J and Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Med Res Methodol* 2008; 8: 45–55.
11. Majid U and Vanstone M. Appraising qualitative research for evidence syntheses: A compendium of quality appraisal tools. *Qual Health Res* 2018; 28: 2115–2131.
12. Critical Appraisal Skills Programme. CASP Qualitative Checklist, <https://casp-uk.net/wp-content/uploads/2018/01/CASP-Qualitative-Checklist-2018.pdf> (2018).
13. Chen S, Gong E, Kazi DS, et al. Using mobile health intervention to improve secondary prevention of coronary heart diseases in China: Mixed-methods feasibility study. *JMIR MHEALTH UHEALTH* 2018; 6: 1–15.
14. Day MA, Anthony CA, Bedard NA, et al. Increasing peri-operative communication with automated mobile phone messaging in total joint arthroplasty. *J Arthroplasty* 2018; 33: 19–24.
15. Edbrooke L, Denehy L, Granger CL, et al. Home-based rehabilitation in inoperable non-small cell lung cancer-the patient experience. *Support Care Cancer* 2020; 28: 99–112.
16. Job JR, Spark LC, Fjeldsoe BS, et al. Women's perceptions of participation in an extended contact text message-based weight loss intervention: An explorative study. *JMIR MHEALTH UHEALTH* 2017; 5: 1–8.
17. Leon N, Surender R, Bobrow K, et al. Improving treatment adherence for blood pressure lowering via mobile phone SMS-messages in South Africa: A qualitative evaluation of the SMS-text adherence SuppoRt (StAR) trial. *BMC Fam Pract* 2015; 16: 1–10.
18. Lilje SC, Olander E, Berglund J, et al. Experiences of older adults with mobile phone text messaging as reminders of home exercises after specialized manual therapy for recurrent low back pain: A qualitative study. *J Med INTERNET Res* 2017; 19: 1–10.
19. Dale L P, Whittaker R, Dixon R, et al. Acceptability of a mobile health exercise-based cardiac rehabilitation intervention: A randomized trial. *J Cardiopulm Rehabil Prev* 2015; 35: 312–319.
20. Redfern J, Santo K, Coorey G, et al. Factors influencing engagement, perceived usefulness and behavioral mechanisms associated with a text message support program. *PLOS ONE* 2016; 11: 1–17.
21. Michie S, van Stralen MM and West R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implement Sci* 2011; 6: 42.
22. Allen NE, Canning CG, Sherrington C, et al. The effects of an exercise program on fall risk factors in people with Parkinson's disease: A randomized controlled trial. *Mov Disord* 2010; 25: 1217–1225.
23. Eichler S, Salzwedel A, Rabe S, et al. The effectiveness of telerehabilitation as a supplement to rehabilitation in patients after total knee or hip replacement: Randomized controlled trial. *JMIR Rehabil Assist Technol* 2019; 6: e14236.
24. Stavric V, Kayes NM, Rashid U, et al. The Effectiveness of Self-Guided Digital Interventions to Improve Physical

- Activity and Exercise Outcomes for People With Chronic Conditions: A Systematic Review and Meta-Analysis. *Front Rehabil Sci* 2022; 3: 925620.
25. Nelligan RK, Hinman RS, Teo PL, et al. Exploring attitudes and experiences of people with knee osteoarthritis toward a self-directed eHealth intervention to support exercise: Qualitative study. *JMIR Rehabil Assist Technol* 2020; 7: e18860.
 26. Maddison R, Pfaeffli L, Whittaker R, et al. A mobile phone intervention increases physical activity in people with cardiovascular disease: Results from the HEART randomized controlled trial. *Eur J Prev Cardiol* 2015; 22: 701–709.
 27. van Vugt V, van der Wouden JC, Essery R, et al. Internet based vestibular rehabilitation with and without physiotherapy support for adults aged 50 and older with a chronic vestibular syndrome in general practice: Three armed randomised controlled trial. *Br Med J* 2019; 367: 15922.
 28. Hallal PC, Simoes E, Reichert FF, et al. Validity and reliability of the telephone-administered international physical activity questionnaire in Brazil. *J Phys Act Health* 2010; 7: 402–409.
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